

## PATENT ABSTRACTS OF JAPAN

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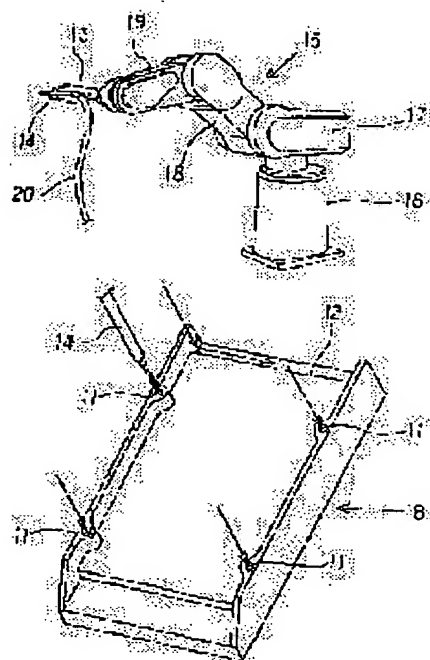
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## (54) WASHING APPARATUS

## (57)Abstract:

**PURPOSE:** To provide a washing apparatus wherein a drying time is shortened and the capacity of a hot air blower may be reduced.

**CONSTITUTION:** A washing apparatus has a washing process to wash a base 8 being a material to be washed using an aqueous washing agent, a rinsing process to remove the aqueous washing agent from the base 8 using pure water, a blow process to drain and evaporate the moisture absorbed in the base 8 using a hot air blower, and a drying process to finally dry the base in a drying atmosphere. Also, an air nozzle 14 is provided to the hand part 13 provided to the leading end of an articulated robot 15. An air blowing process to eject compressed air to the stepped part 12 of the base 8 and the recessed parts such as screw holes of the base 8 in a spot like state in order to forcibly exclude the water stored in the recessed parts is provided between the rinsing process and the blow process.



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CLAIMS

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[Claim(s)]

[Claim 1] The washing process which washes a washed object using a drainage system cleaning agent. The rinsing process which removes the aforementioned drainage system cleaning agent from the aforementioned washed object using pure water. The blow process to which a ridge and evaporation of the moisture which adhered to the aforementioned washed object using warm air Blois are made to carry out. The dryness process which carries out the last dryness of the aforementioned washed object in dryness atmosphere. It is the washing station equipped with the above, and the hand section at the nose of cam of an articulated robot is equipped with an air jet hole, and it is characterized by establishing the air blasting process which eliminates compulsorily the water which blew off in spot and stored the compressed air in the aforementioned step and the crevice between the aforementioned rinsing process and the aforementioned blow process towards the step and crevice of the aforementioned washed object.

[Claim 2] The washing station according to claim 1 by which the position of the step of the washed object in an air blasting process and a crevice is beforehand taught to the articulated robot.

[Claim 3] A rinsing process is a washing station according to claim 1 which consists of each process of a pre rinse, a middle rinse, and a final rinse.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the washing station which washes a printed circuit board and various parts.

[0002]

[Description of the Prior Art] Conventionally, especially chlorofluorocarbon ethane was lengthening the amount used rapidly as a cleaning agent in the electronic related field with the outstanding washing property. However, since this chlorofluorocarbon etc. causes the ozone layer depletion of a stratosphere as everyone knows, the amount used tends to be regulated sharply and it is going to be carried out further to abolition in recent years.

[0003] It is under such a situation, development of extensive alternative washing technology and a cleaning agent is furthered in the washing station which washes a printed circuit board and various parts, and the backwashing-by-water equipment which used the drainage system cleaning agent attracts attention as the leading alternative technology.

[0004] This seed washing station consists of a washing process, a rinsing process, and a dryness process, uses a drainage system cleaning agent in a washing process, and is performing it using pure water in the rinsing process.

[0005] Drawing 4 shows the example of a washing process of the washing station which used the drainage system cleaning agent. Hold a drainage system cleaning agent, and the washing tub 1 and washed object which give and wash a vibration according a washed object to jet, stirring, or an ultrasonic wave of a cleaning agent etc. are immersed into pure water, or give supersonic oscillation at the time of this being immersed, and pure water is further sprayed on a washed object at the time of ecrisis. The 1st, the 2nd, the pre rinse tub 2 that performs the 3rd rinsing, respectively, the middle rinse tub 3, the final rinse tub 4, and a washed object are ventilated in warm air. It has the 1st a ridge and evaporation of the moisture adhering to the washed object are made to perform, the 2nd warm air Blois tubs 5 and 6, and the vacuum-drying tub 7 to which the forced drying of the washed object is carried out.

[0006] The aforementioned vacuum-drying tub 7 arranges a washed object in vacuum atmosphere, lowers the boiling point of water, and promotes evaporation of moisture under low temperature. In addition, if this forced drying has thermal resistance in a washed object, it is good also as composition performed by hot blast.

[0007] As the aforementioned washed object, when using the base 8 for hard disk drive units as shown in drawing 5, as an arrow shows, it shows the washing cage 9 which arranged and held this base 8 in the washing cage 9 which consists of metal rods, such as stainless steel, as it is shown in drawing 6 and drawing 7. after carrying out surface treatment, such as anticorrosion, and held the base 8 of a washed object in this way to drawing 4 one by one inside [ each ] each tubs 1-7.

[0008] Conveyance of the washing cage 9 is performed on a conveyance carrier by hanging the hand section 10 of the both sides of the washing cage 9.

[0009]

[Problem(s) to be Solved by the Invention] By the way, in backwashing by water, by how the ridge after a rinse of a washed object is performed effectively, while being able to aim at shortening of the drying time, washing quality can be improved.

[0010] It rinses in the washing station mentioned above. and behind, the air blow is promoted to the washed object by warm air Blois. and, simultaneously with a carry ridge, evaporation of moisture is promoted by warming.

[0011] However, the aforementioned air blow having unarranged [ to which waterdrop collects on these concave surfaces, and a being easy ridge will specifically become / upper part / of the warm air Blois layers 5 and 6 ] imperfect from the outside of the washing cage 9 which contained the washed object in order to only ventilate the whole washed object when it has a crevice, for example, the tapped hole 11 for base

fixation and a step 12, on the surface of a washed object, or when it has boom hoisting complicated on a front face /.

[0012] For this reason, in order to dry waterdrop collected on the concave surface certainly for the process of warm air Blois and a vacuum drying not only to take a long time, but [ in order to obtain a predetermined drying property, ], the capacity, i.e., the ventilation capacity, and the heat capacity of warm air Blois must be enlarged, and it has problems, such as causing large-sized-ization of equipment.

[0013] the place which this invention is made with careful attention to such a trouble that a Prior art has, and is made into the purpose is to offer the washing station which can aim at shortening of the drying time and can aim at capacity reduction which is warm air Blois

[0014]

[Means for Solving the Problem] In order to attain the aforementioned purpose, it sets to the washing station of this invention. The washing process which washes a washed object using a drainage system cleaning agent, and the rinsing process which removes a drainage system cleaning agent from a washed object using pure water, The blow process to which a ridge and evaporation of the moisture which adhered to the washed object using warm air Blois are made to carry out, It has the dryness process which carries out the last dryness of the washed object in dryness atmosphere. The hand section at the nose of cam of an articulated robot is equipped with an air jet hole, and it is characterized by establishing the air blasting process which eliminates compulsorily the water which blew off in spot and stored the compressed air in this step and crevice between a rinsing process and a blow process towards the step and crevice of a washed object.

[0015]

[Function] If it is in the washing station of composition of having mentioned above, the hand section of an articulated robot moves to the washed object which finished the rinsing process according to the positional information taught beforehand, while the air jet hole with which the hand section was equipped is carried to each position of the step of a washed object, and a crevice, the blowdown of the air of an air jet hole is turned on [ it ] in the position of the step of a washed object, and a crevice, and the compressed air blows off in spot to the step and crevice of

[0016] Therefore, water collected on the step and crevice of a washed object is blown away by blasting of the compressed air, forcible removal also of the moisture which adhered on the surface of the washed object at the subsequent blow process is carried out, a ridge becomes certain, and is easy to dry and will become good [ the quality ].

[0017]

[Example] It explains about the example of this invention using drawing 1 - drawing 3 . In addition, in these drawings, the thing of the same sign as the sign explained by the Prior art is taken as the same or the thing which shows a corresponding thing.

[0018] Drawing 1 shows the example of a washing process of the washing station of this invention which used the drainage system cleaning agent. Pure water is sprayed on the washing tub 1 and washed object which hold a drainage system cleaning agent, and give and wash a vibration according a washed object to jet, stirring, or an ultrasonic wave of a cleaning agent etc. The 1st, the 2nd, the pre rinse tub 2 that performs the 3rd rinsing, respectively, the middle rinse tub 3, the final rinse tub 4, and a washed object are ventilated in warm air. It has the 1st a ridge and evaporation of the moisture adhering to the washed object are made to perform. the 2nd warm air Blois tubs 5 and 6, and the vacuum-drying tub 7 to which the forced drying of the washed object is carried out.

[0019] And the articulated robot 15 which attached the air jet hole 14 in the nose-of-cam hand section 13 is arranged between the final rinse tub 4 which performs the 3rd rinsing, and the 1st warm air Blois tub 5 which performs the 1st air blow, and it is made to prepare an air blasting process in it between a rinsing process and a blow process in this invention.

[0020] This articulated robot 15 is equipped with the hand section 13 which rotates [ list-pitch- ] and rotates [ list-roll- ] to the 1st arm 17 which carries out waist rotation to a pedestal 16, the 2nd arm 18 which carries out shoulder rotation to this 1st arm 17, the 3rd arm 19 which carries out elbow rotation to the 2nd arm 18, and the 3rd arm 19 as shown in drawing 2 .

[0021] The air jet hole 14 attached in the hand section 13 of an articulated robot 15 is for spouting in spot the compressed air supplied through an air hose 20, and the movement of the hand section 13 and opening and closing of the blowdown of the air from an air jet hole 14, i.e., an air supply valve, are beforehand set up according to the configuration of a washed object.

[0022] That is, as a washed object, the base 8 for hard disk drive units is used, for example like the conventional example. As shown in this base 8 at drawing 3 , the tapped hole 11 for base fixation and a step 12 are formed in the front face, and water is easy to collect on such a concave surface.

[0023] And the movement of an articulated robot 15 is taught as it can move to the position where the air

jet hole 14 met the position and step 12 of each tapped hole 11 one by one to such the base 8, and when it arrives at the position where the air jet hole 14 met the position and step 12 of each tapped hole 11 further, opening and closing of an air supply valve are programmed so that blasting of air is performed.

[0024] It is arranged and held in a washing cage, and after the aforementioned base 8 carries out surface treatment, such as anticorrosion, as an arrow shows to drawing 1 with a conveyance carrier, it is shown to this washing cage to it one by one in each interior of each tubs 1-7, and the position of an air blasting process.

[0025] If it is in the washing station of such composition and is shown in the position of an air blasting process, the washed object 8, i.e., the base, which finished each the 1st, the 2nd, and 3rd rinsing after washing. An articulated robot 15 starts an operation and an air jet hole 14 receives each base 8. As drawing 3 showed, it shows around in each spot position of the tapped hole 11 taught beforehand and a step 12, respectively, and simultaneously, when an air jet hole 14 is guided in each spot position, an air supply valve is controlled by open.

[0026] Therefore, to each base 8 after a rinse, the waterdrop which the air from an air jet hole 14 was sprayed with vigor sufficient in spot on the tapped hole 11 and the step 12, and had collected on the tapped hole 11 and the step 12 after the rinse will be around blown away by blasting of air, the concave puddle which had become a neck conventionally will be canceled, and a ridge will be performed effectively.

[0027] Thus, the base 8 where the ridge was performed is shown after that at each process of warm air Blois and a vacuum drying, and dryness of a washed object is performed. Since there is no \*\*\*\*\* of waterdrop in the front face of the base 8 which is a washed object at the time of this dryness, that is, a dryness load becomes very small, while being able to make small capacity required for warm air Blois and a vacuum drying and being able to reduce the heating capacity and ventilation capacity in the 1st and the 2nd warm air Blois layers 5 and 6, shortening of the drying time is attained.

[0028] As mentioned above, although the example of the washing station according to this invention was explained, various deformation or corrections are possible for this invention, without not being limited to these examples and deviating from the range of this invention.

[0029]

[Effect of the Invention] Since this invention is constituted as explained above, it does so an effect which is indicated below. Since the water stored in this step and crevice by having established the air blasting process which spouts the compressed air in spot towards the step and crevice of a washed object between a rinsing process and a blow process by the air jet hole of the hand section of an articulated robot can be eliminated compulsorily and it can drain off water from it, while being able to reduce the dryness capacity in a subsequent blow process and a subsequent dryness process, shortening of the drying time can be attained.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is explanatory drawing of a washing process showing the 1st example of the washing station of this invention.

[Drawing 2] It is the perspective diagram of the articulated robot used by the washing station of drawing 1.

[Drawing 3] It is the perspective diagram of the base for hard disk drive units applied as a washed object by the washing station of drawing 1.

[Drawing 4] It is explanatory drawing of a washing process showing the conventional washing station.

[Drawing 5] It is the perspective diagram of the base for hard disk drive units used as a washed object by the washing station of drawing 4.

[Drawing 6] It is the front view of the washing cage which held the base of drawing 4.

[Drawing 7] It is the side elevation of drawing 6.

[Description of Notations]

8 Base

11 Tapped Hole

12 Step

13 Hand Section

14 Air Jet Hole

15 Articulated Robot

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[Translation done.]





(2)

## 【特許請求の範囲】

【請求項1】 被洗浄物を水系洗浄剤を用いて洗浄する洗浄工程と、純水を用いて前記被洗浄物から前記水系洗浄剤を取り除くすすぎ工程と、温風ブローを用いて前記被洗浄物に付着した水分の水切り・蒸発を行わせるブロー工程と、前記被洗浄物を乾燥雰囲気中で最終乾燥させる乾燥工程とを有する洗浄装置であって、多関節ロボットの先端のハンド部にエアノズルを備え、前記被洗浄物の段部及び凹部に向けて圧縮空気をスポット的に噴出し前記段部及び凹部に貯留した水を強制的に排除するエア吹き付け工程を、前記すすぎ工程と前記ブロー工程との間に設けたことを特徴とする洗浄装置。

【請求項2】 多関節ロボットには、エア吹き付け工程における被洗浄物の段部及び凹部の位置が予め教示されている請求項1記載の洗浄装置。

【請求項3】 すすぎ工程は、プレリンス、ミドルリンス、ファイナルリンスの各工程からなる請求項1記載の洗浄装置。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、プリント基板や各種部品を洗浄する洗浄装置に関する。

## 【0002】

【従来の技術】従来、フロン・エタンはその優れた洗浄特性により、特に、電子関連分野で洗浄剤として使用量を急激に伸ばしていた。しかしながら、このフロン等は周知のように成層圏のオゾン層破壊を引き起こすことから、近年その使用量が大幅に規制され、更には全廃へされようとしている。

【0003】このような状況下にあつて、プリント基板や各種部品を洗浄する洗浄装置においては、広範な代替洗浄技術及び洗浄剤の開発が進められ、その有力な代替技術として、水系洗浄剤を使用した水洗浄装置が注目されている。

【0004】この種洗浄装置は、洗浄工程、すすぎ工程及び乾燥工程からなり、洗浄工程において水系洗浄剤を使用し、すすぎ工程において純水を用いて行っている。

【0005】図4は、水系洗浄剤を使用した洗浄装置の洗浄工程例を示したものであり、水系洗浄剤を収容し被洗浄物を洗浄剤の噴出或いは攪拌もしくは超音波などによる振動を与えて洗浄する洗浄槽1、被洗浄物を純水中に浸漬しあるいはこの浸漬時に超音波振動を与えさらには排出時に被洗浄物に純水を噴霧して第1、第2、第3のすすぎをそれぞれ行うプレリンス槽2、ミドルリンス槽3、ファイナルリンス槽4、被洗浄物に温風を送風して被洗浄物に付着した水分の水切り及び蒸発を行わせる第1、第2温風ブロー槽5、6、被洗浄物を強制乾燥させる真空乾燥槽7を備えている。

【0006】前記真空乾燥槽7は、被洗浄物を真空雰囲気中に配置して水の沸点を下げ、低温下で水分の蒸発を

2

促進させるものである。なお、この強制乾燥は、被洗浄物に耐熱性があれば熱風により行う構成としてもよい。

【0007】前記被洗浄物として、例えば図5に示すようなハードディスク装置用のベース8を用いる場合、このベース8を耐食等の表面処理をした後、図6及び図7に示すように、ステンレス等の金属棒からなる洗浄かご9に配列して収容し、このように被洗浄物のベース8を収容した洗浄かご9を、図4に矢印で示すように各槽1～7のそれぞれの内部に順次案内する。

10 【0008】洗浄かご9の搬送は、搬送キャリアに洗浄かご9の両側のハンド部10を吊り下げて行う。

## 【0009】

【発明が解決しようとする課題】ところで、水洗浄においては、被洗浄物のすすぎ後の水切りをいかに効果的に行うかによって、乾燥時間の短縮を図ることができると共に、洗浄品質を向上することができるものである。

【0010】前述した洗浄装置では、すすぎ後に温風ブローによって被洗浄物にエアブローを行い、水切りと同時に、加温により水分の蒸発を促進させている。

20 【0011】しかしながら、前記エアブローは、被洗浄物を収納した洗浄かご9の外側から、具体的には温風ブロー層5、6の上方から、被洗浄物全体に送風するだけであるため、被洗浄物の表面に凹部例えばベース固定用ねじ穴11や段部12を有する場合、或いは表面に複雑な起伏を有する場合、これら凹面に水滴が溜まり易く、水切りが不完全なものになる不都合がある。

【0012】このため、所定の乾燥性を得るためには、温風ブロー及び真空乾燥の工程に長時間を要するだけでなく、凹面に溜まった水滴を確実に乾燥させるために温風ブローの容量つまり送風容量及び熱容量を大きくしなければならず、装置の大形化を招く等の問題を有している。

30 【0013】本発明は、従来の技術の有するこのような問題点に留意してなされたものであり、その目的とするところは、乾燥時間の短縮を図り、温風ブローの容量低減を図ることができる洗浄装置を提供することにある。

## 【0014】

【課題を解決するための手段】前記目的を達成するために、本発明の洗浄装置においては、被洗浄物を水系洗浄剤を用いて洗浄する洗浄工程と、純水を用いて被洗浄物から水系洗浄剤を取り除くすすぎ工程と、温風ブローを用いて被洗浄物に付着した水分の水切り・蒸発を行わせるブロー工程と、被洗浄物を乾燥雰囲気中で最終乾燥させる乾燥工程とを有し、かつ、多関節ロボットの先端のハンド部にエアノズルを備え、被洗浄物の段部及び凹部に向けて圧縮空気をスポット的に噴出しこの段部及び凹部に貯留した水を強制的に排除するエア吹き付け工程を、すすぎ工程とブロー工程との間に設けたことを特徴としている。

50 【0015】

3

【作用】前述した構成の洗浄装置にあっては、すすぎ工程を終えた被洗浄物に対し、多関節ロボットのハンド部が予め教示された位置情報に従って移動し、ハンド部に備えられたエアノズルが被洗浄物の段部及び凹部のそれぞれの位置に運ばれると共に、エアノズルのエアの吹き出しが被洗浄物の段部及び凹部の位置でオンになり、被洗浄物の段部及び凹部に圧縮空気がスポット的に噴出される。

【0016】従って、被洗浄物の段部及び凹部に溜まった水は圧縮空気の吹き付けにより吹き飛ばされ、その後のブロー工程で被洗浄物の表面に付着した水分も強制除去され、水切りが確実となり、乾燥が容易でその品質も良好なものとなる。

【0017】

【実施例】本発明の実施例につき、図1～図3を用いて説明する。なお、これらの図面において、従来の技術で説明した符号と同一符号のものは同一もしくは相当するものを示すものとする。

【0018】図1は、水系洗浄剤を使用した本発明の洗浄装置の洗浄工程例を示したものであり、水系洗浄剤を収容し被洗浄物を洗浄剤の噴出或いは攪拌もしくは超音波などによる振動を与えて洗浄する洗浄槽1、被洗浄物に純水を噴霧して第1、第2、第3のすすぎをそれぞれ行うプレリンス槽2、ミドルリンス槽3、ファイナルリンス槽4、被洗浄物に温風を送風して被洗浄物に付着した水分の水切り及び蒸発を行わせる第1、第2温風ブロー槽5、6、被洗浄物を強制乾燥させる真空乾燥槽7を備えている。

【0019】そして、本発明では、第3のすすぎを行うファイナルリンス槽4と第1エアブローを行う第1温風ブロー槽5との間に、先端ハンド部13にエアノズル14を取り付けた多関節ロボット15を配設し、すすぎ工程とブロー工程との間にエア吹き付け工程を設けるようにしている。

【0020】この多関節ロボット15は、図2に示すように、基台16に対してウエスト回転する第1アーム17、この第1アーム17に対してショルダ回転する第2アーム18、第2アーム18に対してエルボ回転する第3アーム19、第3アーム19に対してリストピッチ回転及びリストロール回転するハンド部13を備えている。

【0021】多関節ロボット15のハンド部13に取り付けられたエアノズル14は、エアホース20を通して供給されてくる圧縮空気をスポット的に噴出するためのものであり、ハンド部13の動きと、エアノズル14からのエアの吹き出しつまりエア供給弁の開閉とが、予め被洗浄物の形状に応じて設定されている。

【0022】すなわち、被洗浄物としては、例えば従来例と同様にハードディスク装置用ベース8が用いられる。このベース8には、図3に示すように、その表面に

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ベース固定用ねじ穴11や段部12が形成され、このような凹面に水が溜まり易くなっている。

【0023】そして、このようなベース8に対して、エアノズル14が各ねじ穴11の位置及び段部12に沿った位置に順次移動できるよう多関節ロボット15の動きが教示され、さらに、エアノズル14が各ねじ穴11の位置及び段部12に沿った位置に到達したときにエアの吹き付けが行われるようエア供給弁の開閉がプログラムされている。

10 【0024】前記ベース8は、耐食等の表面処理をした後、洗浄かごに配列して収容され、この洗浄かごが、搬送キャリアにより図1に矢印で示すように各槽1～7のそれぞれの内部及びエア吹き付け工程の位置に順次案内される。

【0025】このような構成の洗浄装置にあっては、洗浄後、第1、第2、第3の各すすぎを終えた被洗浄物つまりベース8がエア吹き付け工程の位置に案内されると、多関節ロボット15が作動を開始し、エアノズル14が個々のベース8に対して、図3で示したように予め教示されたねじ穴11及び段部12の各スポット位置にそれぞれ案内され、同時に、エアノズル14が各スポット位置に案内された時にエア供給弁が開に制御される。

【0026】従って、すすぎ後の各ベース8に対して、ねじ穴11及び段部12にエアノズル14からのエアがスポット的に勢よく吹き付けられ、すすぎ後にねじ穴11及び段部12に溜まっていた水滴は、エアの吹き付けにより周囲に吹き飛ばされ、従来ネックになっていた凹面の水溜まりが解消され、水切りが効果的に

30 われることになる。

【0027】このようにして水切りが行われたベース8は、その後、温風ブロー及び真空乾燥の各工程に案内され、被洗浄物の乾燥が行われる。この乾燥時、被洗浄物であるベース8の表面には水滴の溜まりが全くなく、つまり乾燥負荷が非常に小さくなるため、温風ブロー及び真空乾燥に必要な容量を小さくすることができ、第1、第2温風ブロー層5、6におけるヒータ容量及び送風容量を低減できると共に、乾燥時間の短縮化が可能になるものである。

40 【0028】以上、本発明に従う洗浄装置の具体例について説明したが、本発明はこれら具体例に限定されるものではなく、本発明の範囲を逸脱することなく種々の変形乃至修正が可能である。

【0029】

【発明の効果】本発明は、以上説明したように構成しているため、次に記載するような効果を奏する。すすぎ工程とブロー工程との間に、多関節ロボットのハンド部のエアノズルにより被洗浄物の段部及び凹部に向けて圧縮空気をスポット的に噴出するエア吹き付け工程を設けたことにより、この段部及び凹部に貯留した水を強制

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(4)

的に排除し、水切りすることができるため、その後のブロー工程並びに乾燥工程における乾燥容量を低減できると共に、乾燥時間の短縮化を図ることができる。

【図面の簡単な説明】

【図1】本発明の洗浄装置の第1実施例を示す洗浄工程の説明図である。

【図2】図1の洗浄装置で使用する多関節ロボットの斜視図である。

【図3】図1の洗浄装置で被洗浄物として適用するハードディスク装置用ベースの斜視図である。

【図4】従来の洗浄装置を示す洗浄工程の説明図である。

【図5】図4の洗浄装置で被洗浄物として使用するハードディスク装置用ベースの斜視図である。

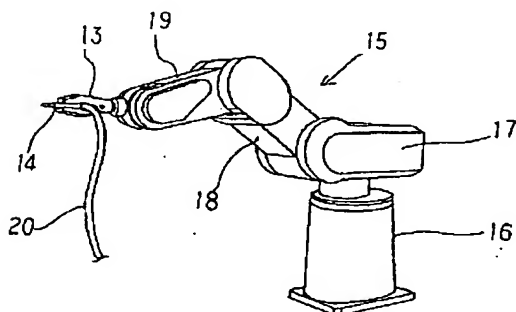
【図6】図4のベースを収容した洗浄かごの正面図である。

【図7】図6の側面図である。

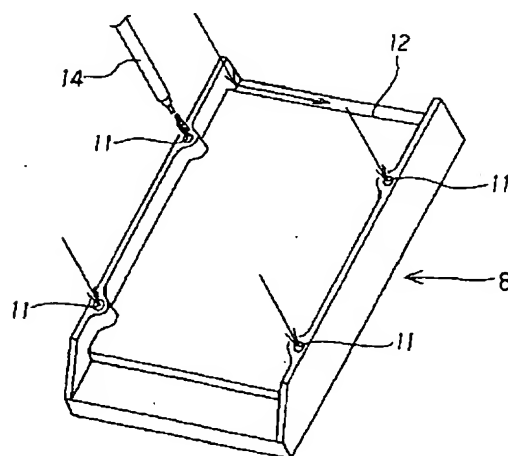
【符号の説明】

- 8 ベース
- 11 ねじ穴
- 12 段部
- 13 ハンド部
- 14 エアーノズル
- 15 多関節ロボット

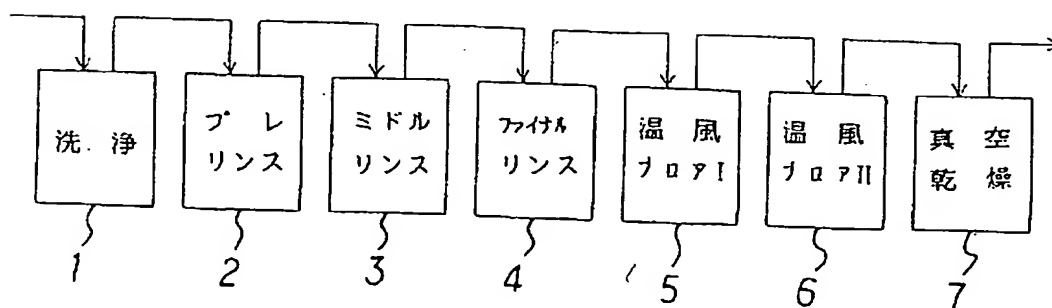
【図2】



【図3】

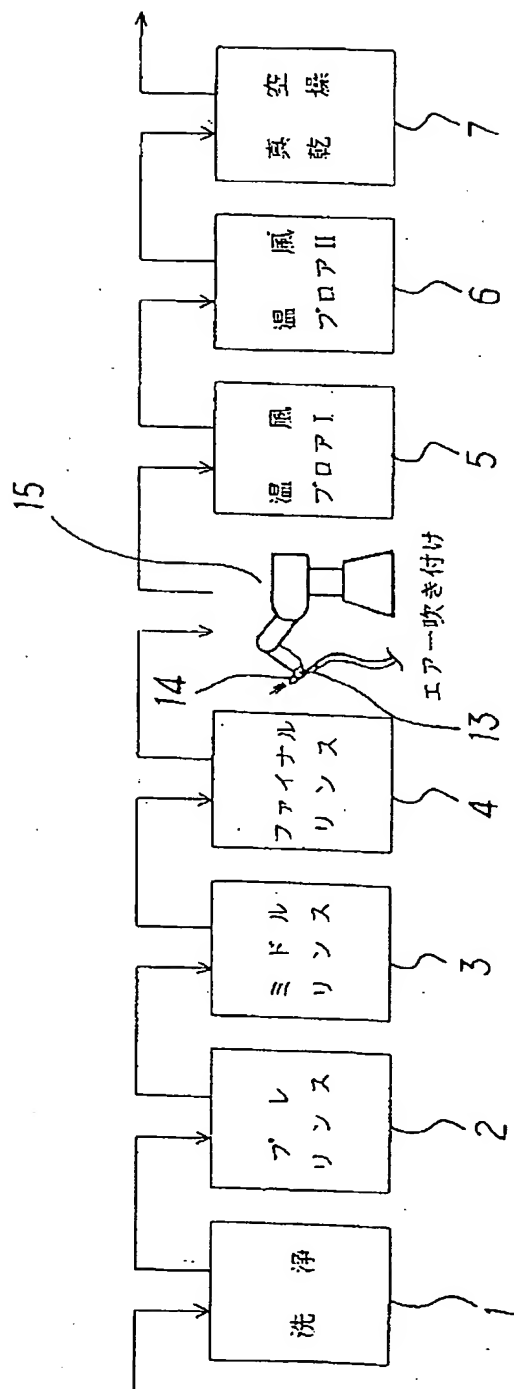


【図4】



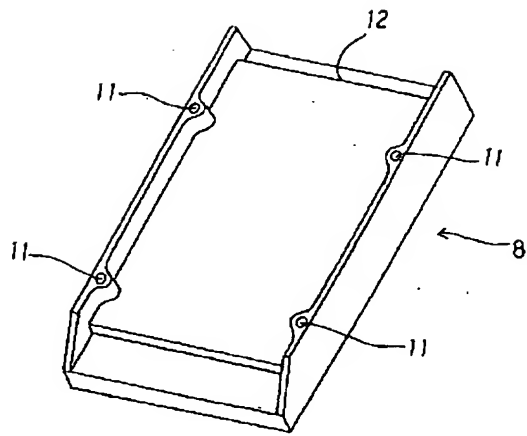
(5)

【図1】

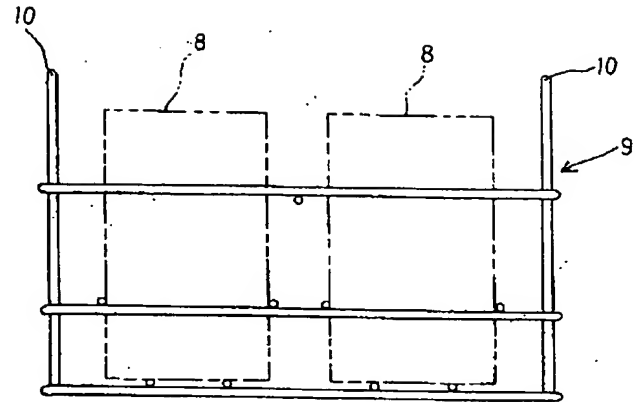


(6)

【図5】



【図6】



【図7】

